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Naruse et al.

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(54) **POSTURE ADJUSTING APPARATUS AND INKJET IMAGE FORMING APPARATUS**

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B41J 25/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 25/006*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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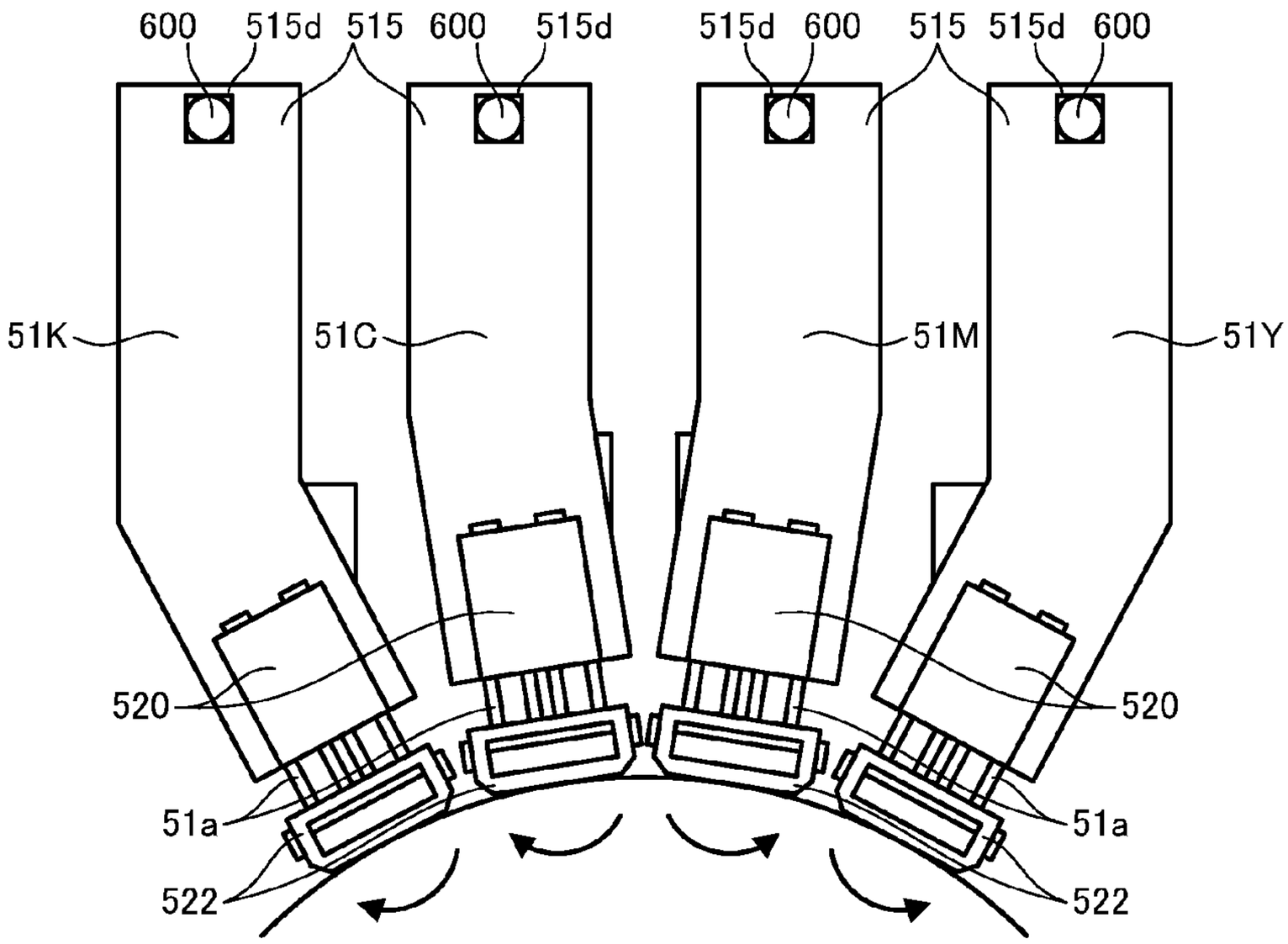
(57) **ABSTRACT**

A posture adjusting apparatus includes: an ink ejector that has a detachable inkjet head that ejects ink; and a posture adjuster for adjusting a posture of the ink ejector. The ink ejector includes a head fixing member to/from which the inkjet head is attached and detached, and is movable between a first position where an image is formed on a recording medium by the inkjet head and a second position where the inkjet head is attached and detached, and the posture adjuster allows adjustment of an angle of the head fixing member in the second position.

17 Claims, 15 Drawing Sheets



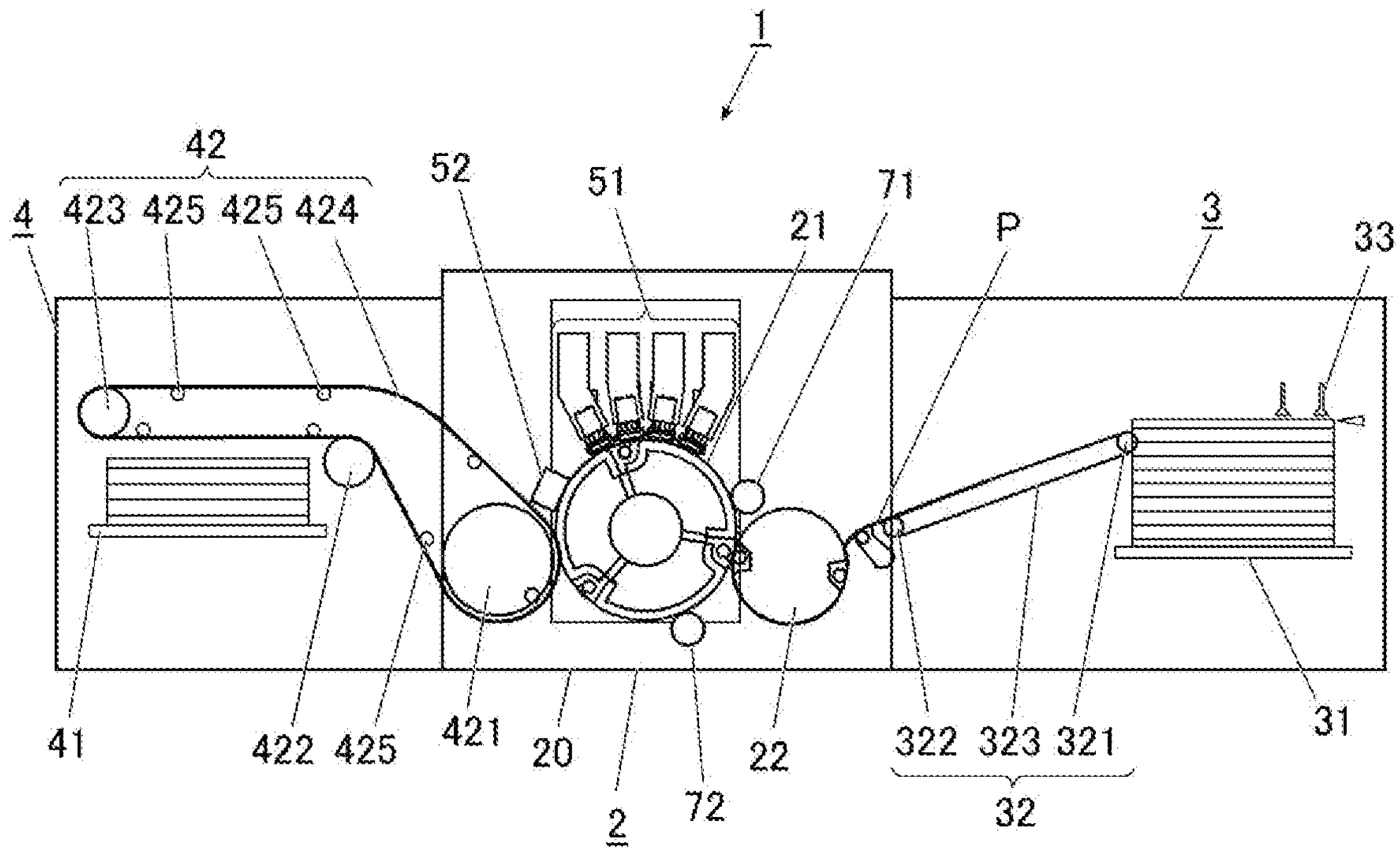

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FIG. 1

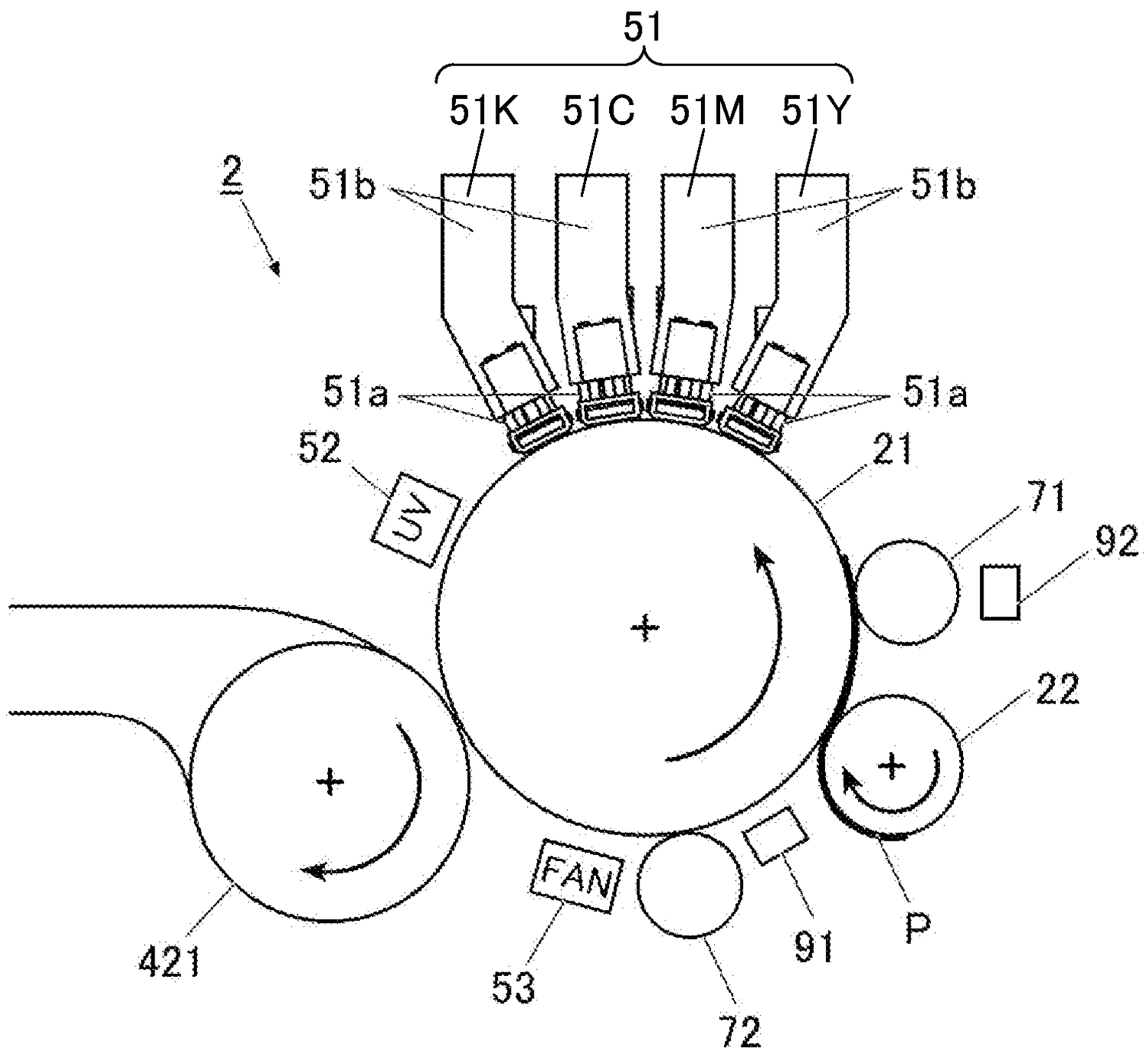
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FIG. 2

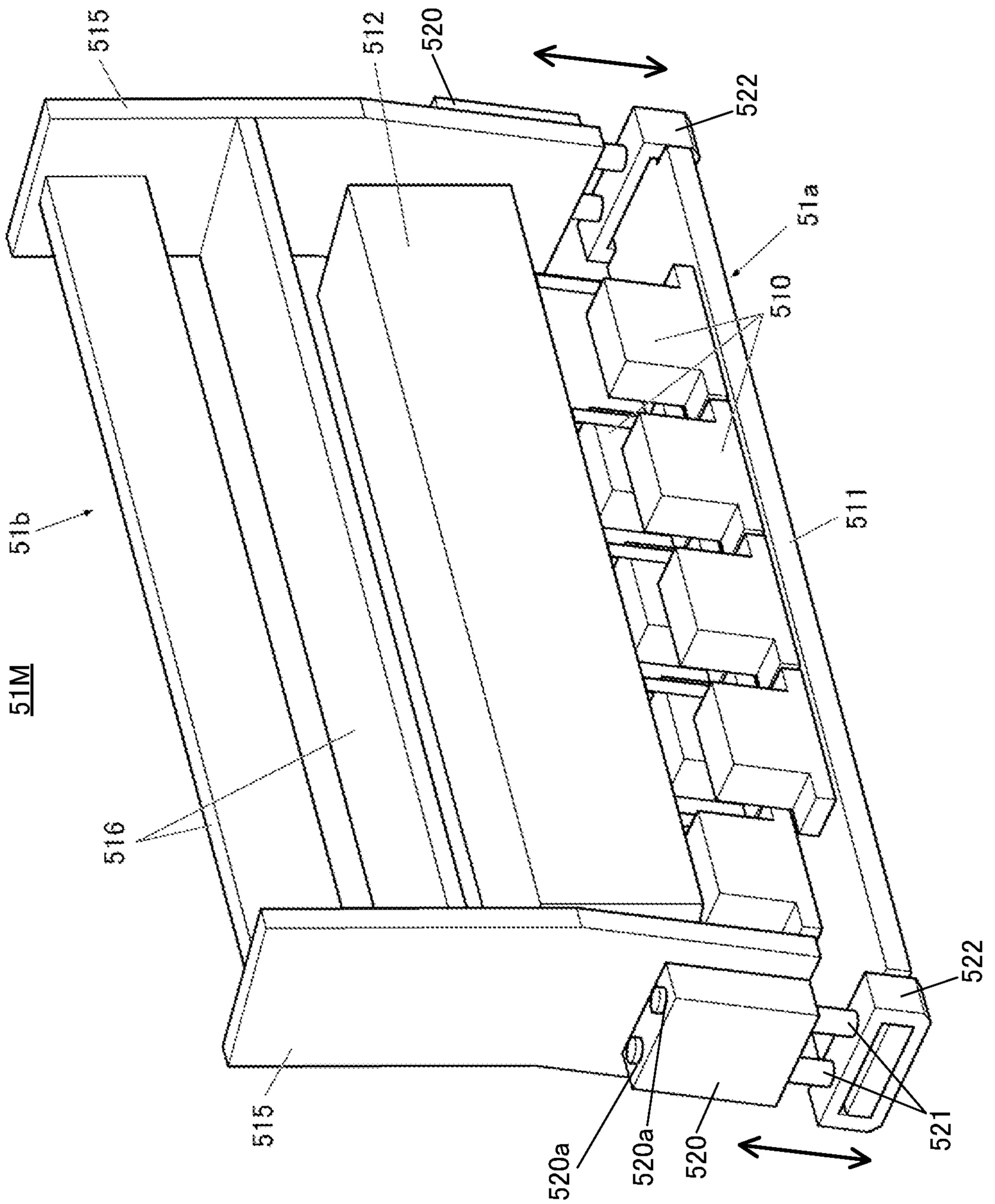
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FIG. 3

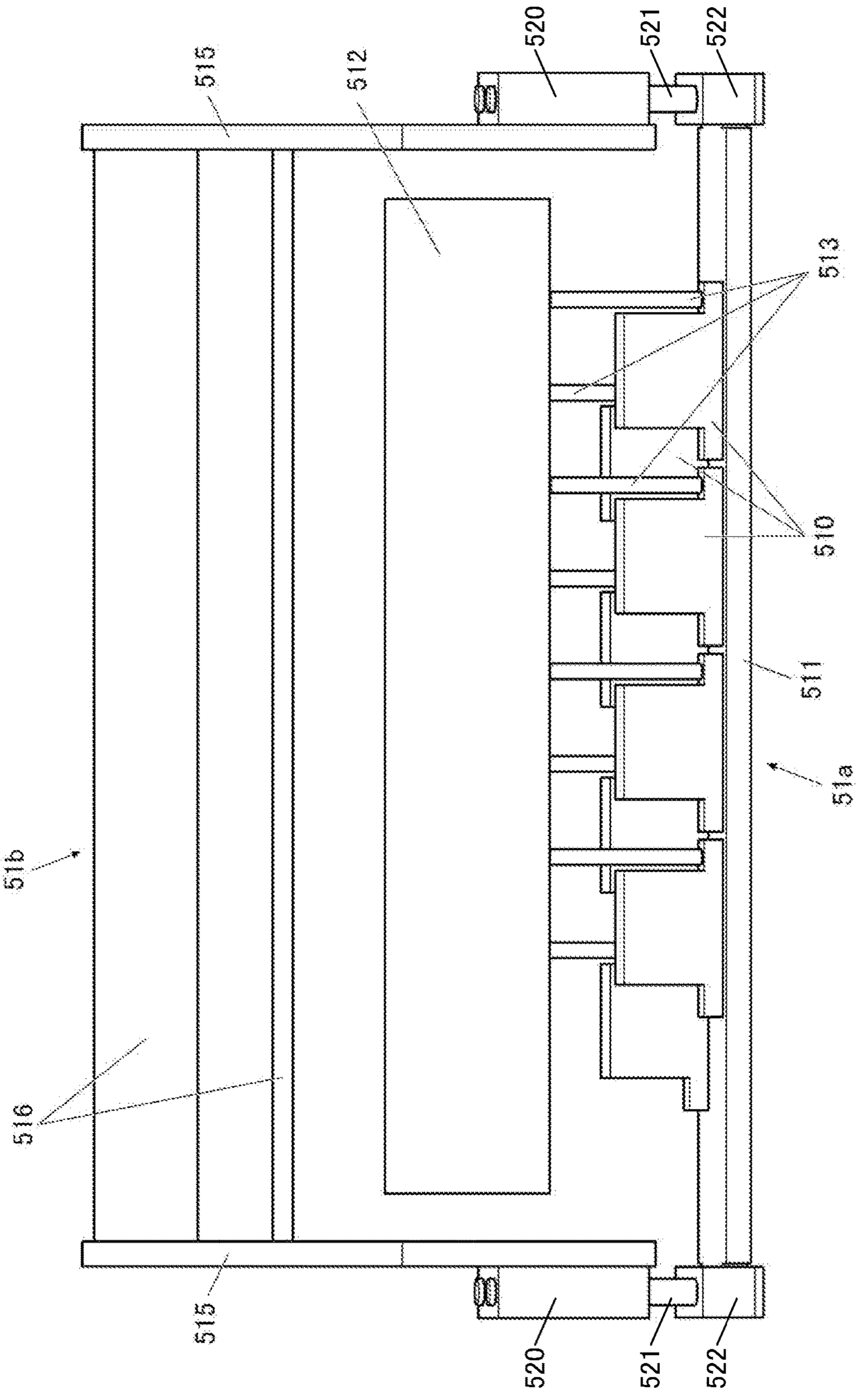


FIG. 4

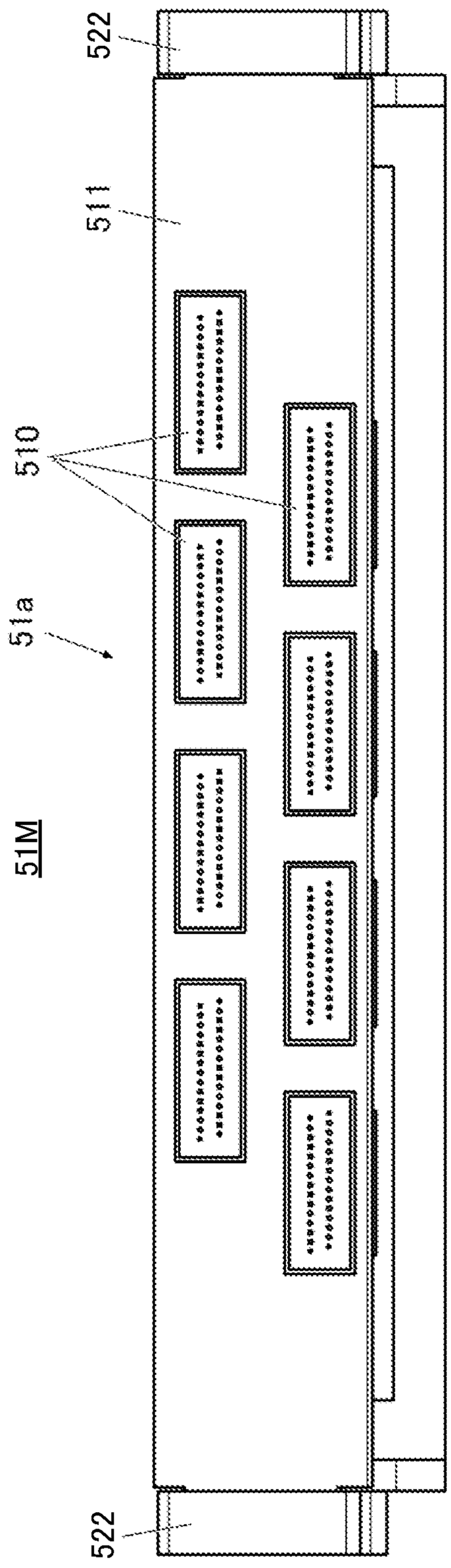


FIG. 5

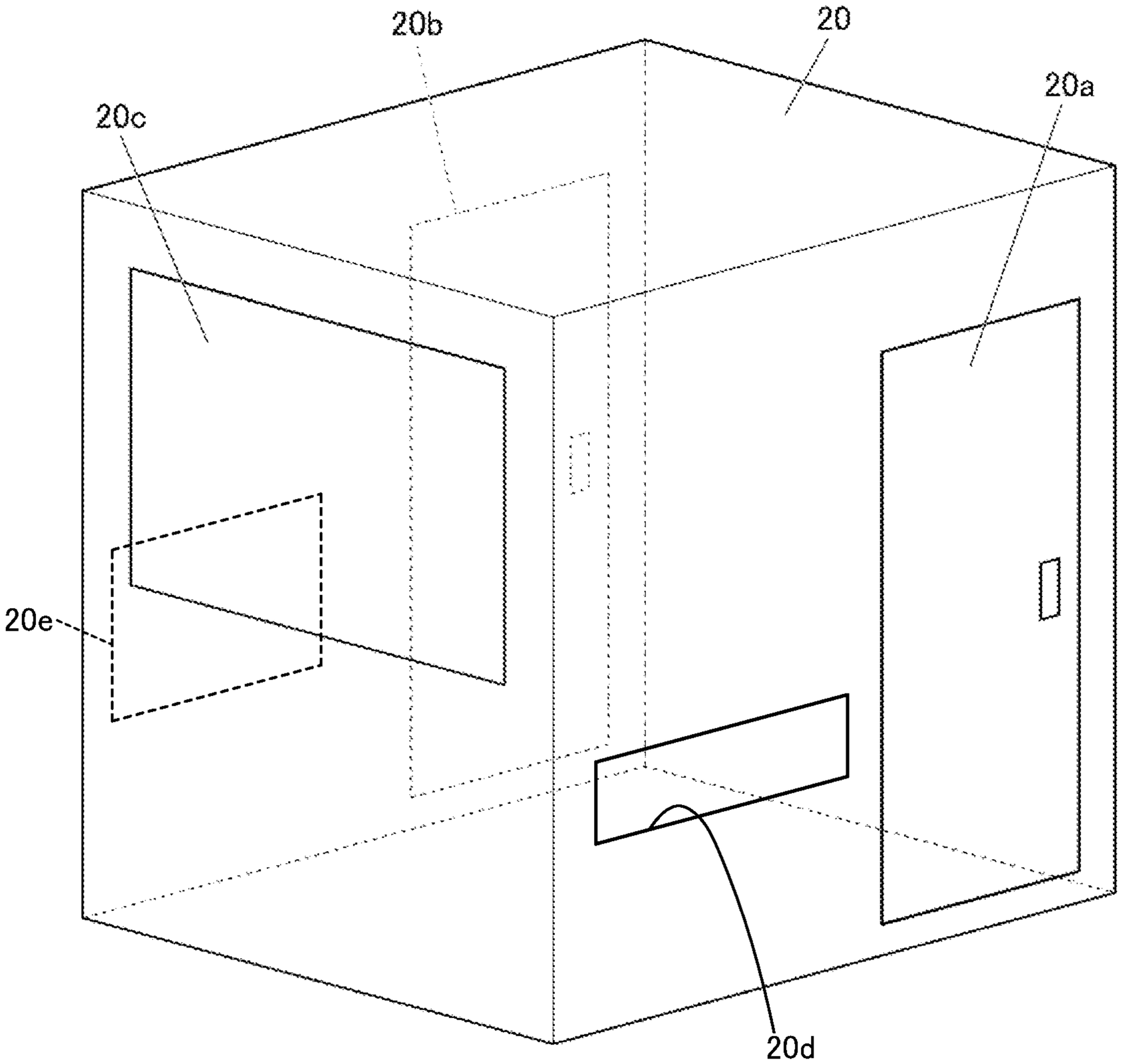


FIG. 6

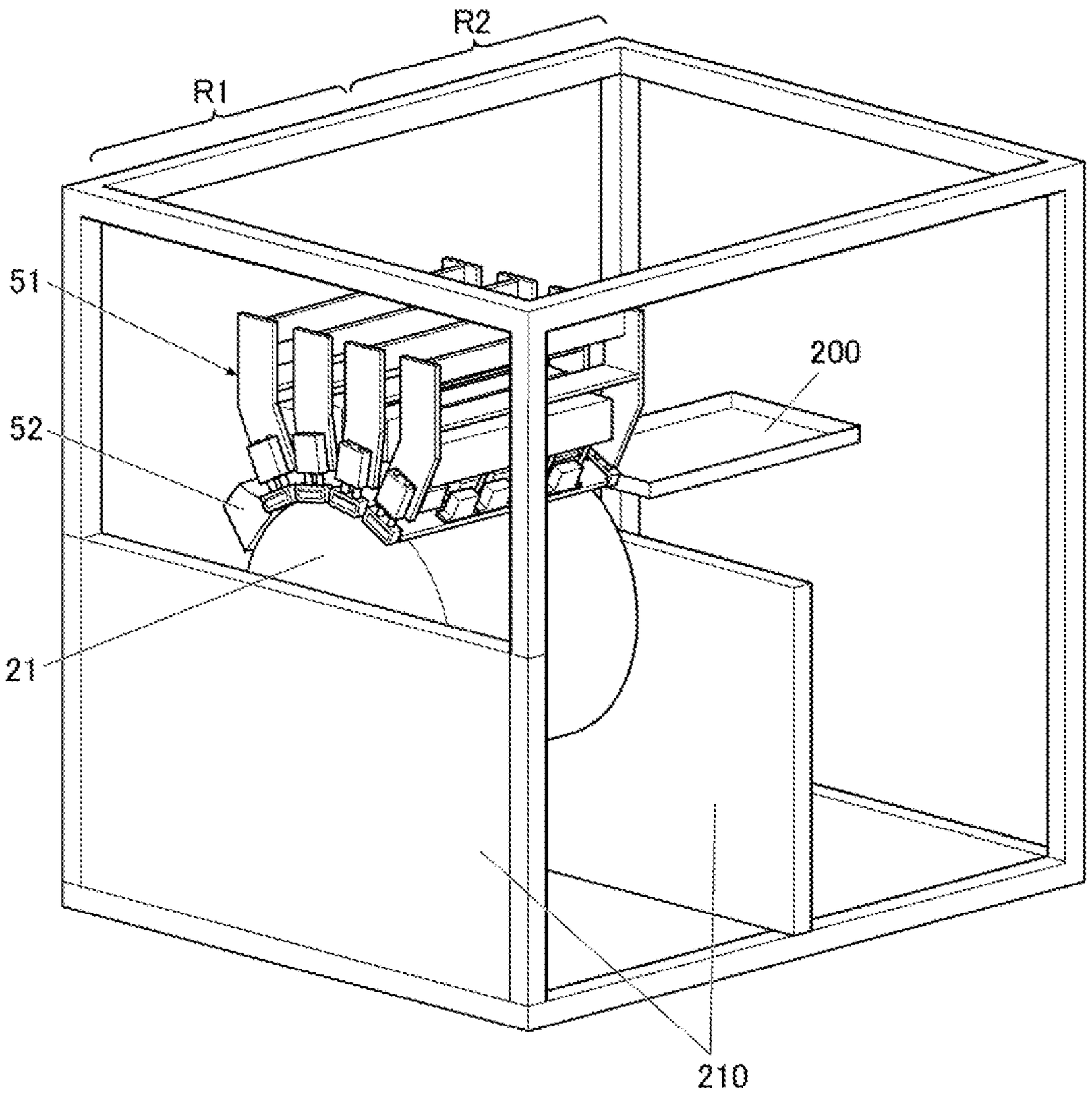
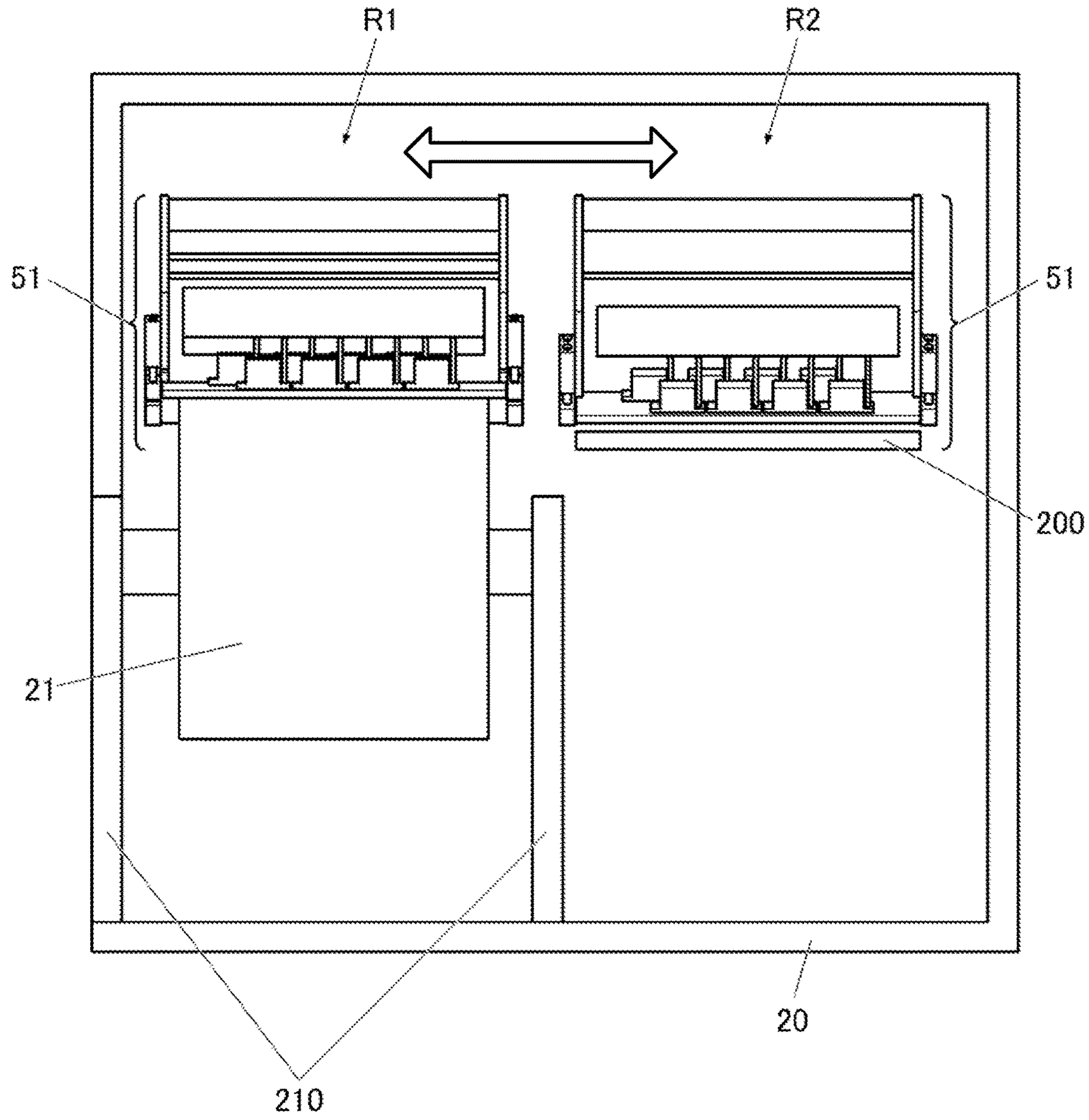


FIG. 7



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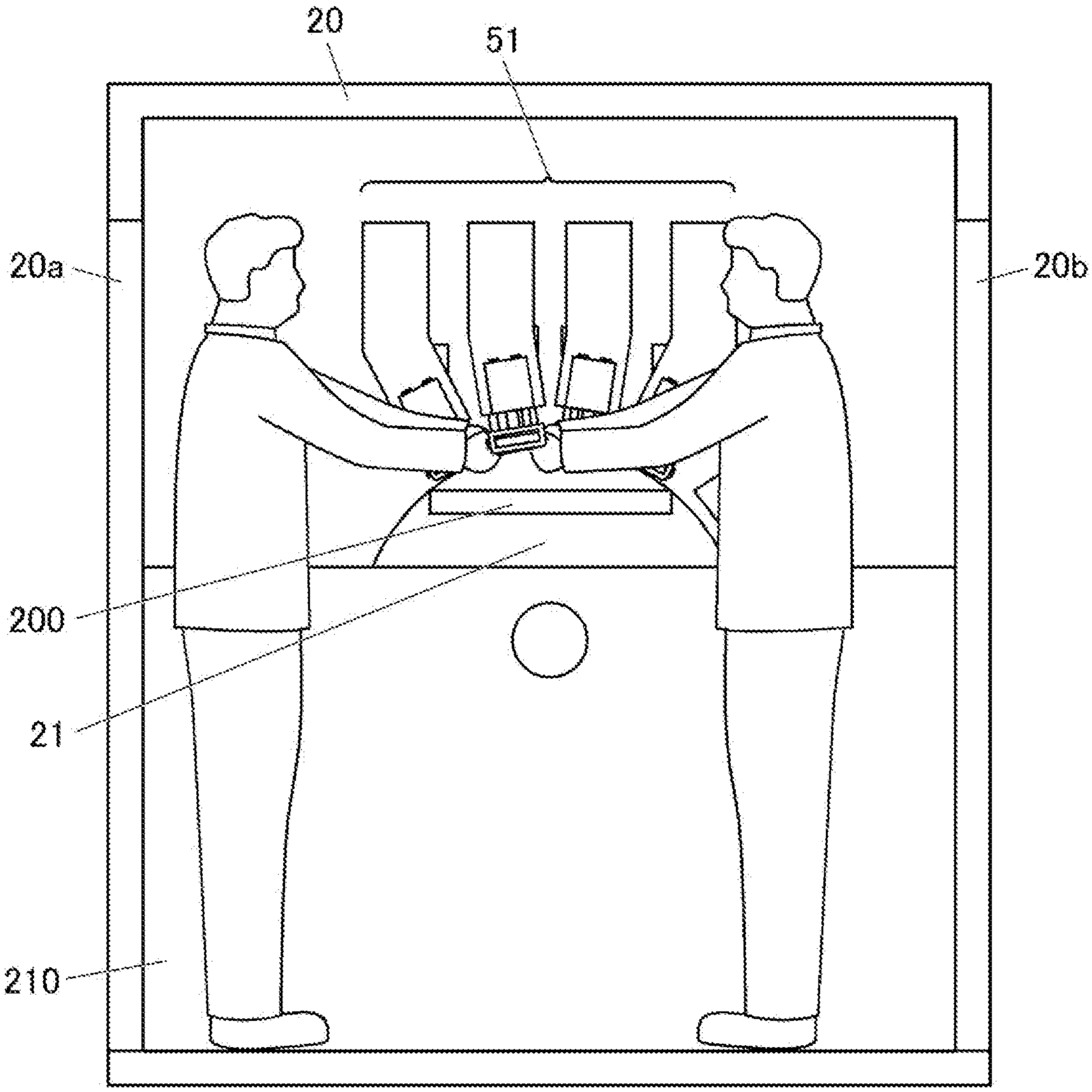

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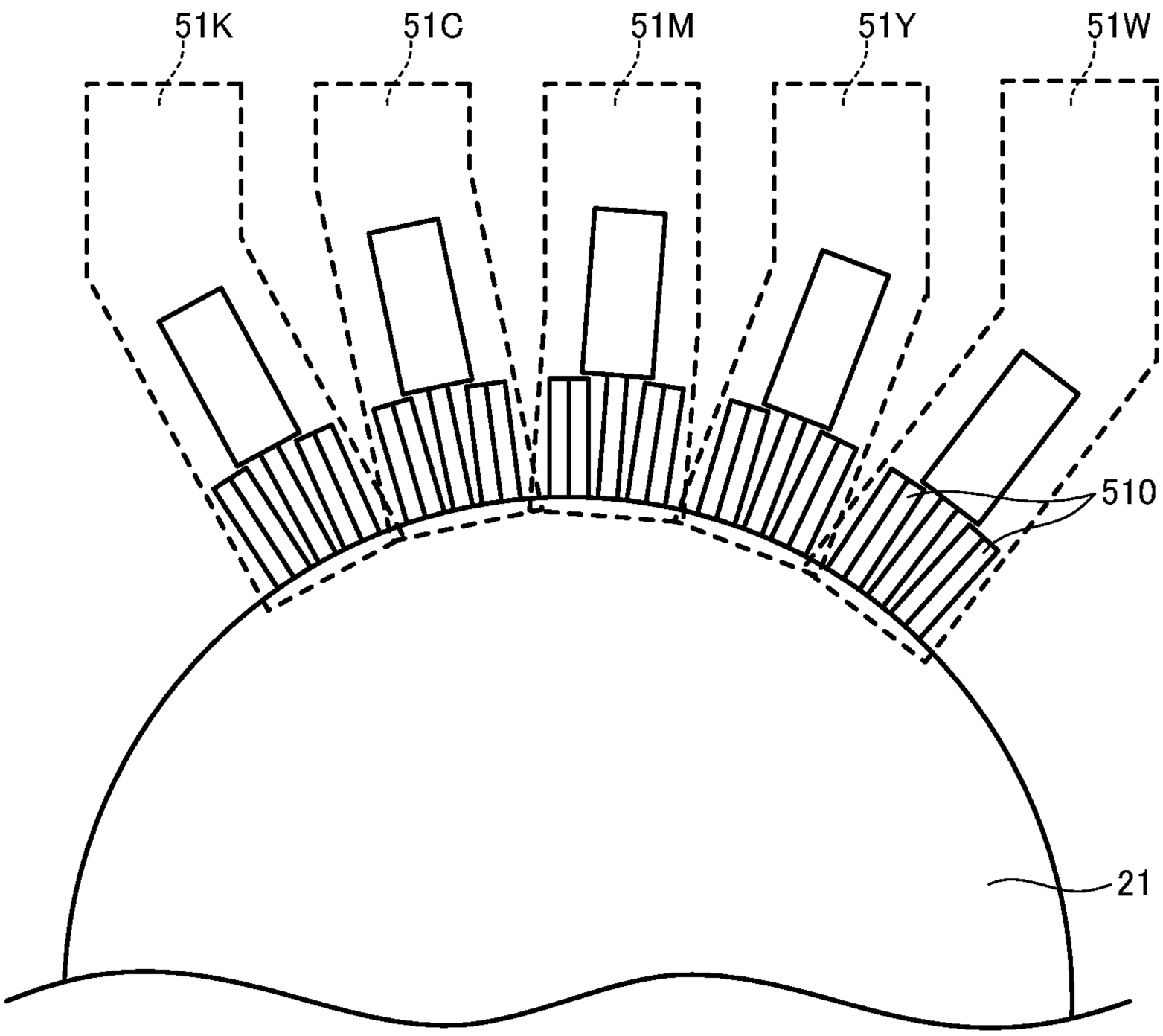

FIG. 10

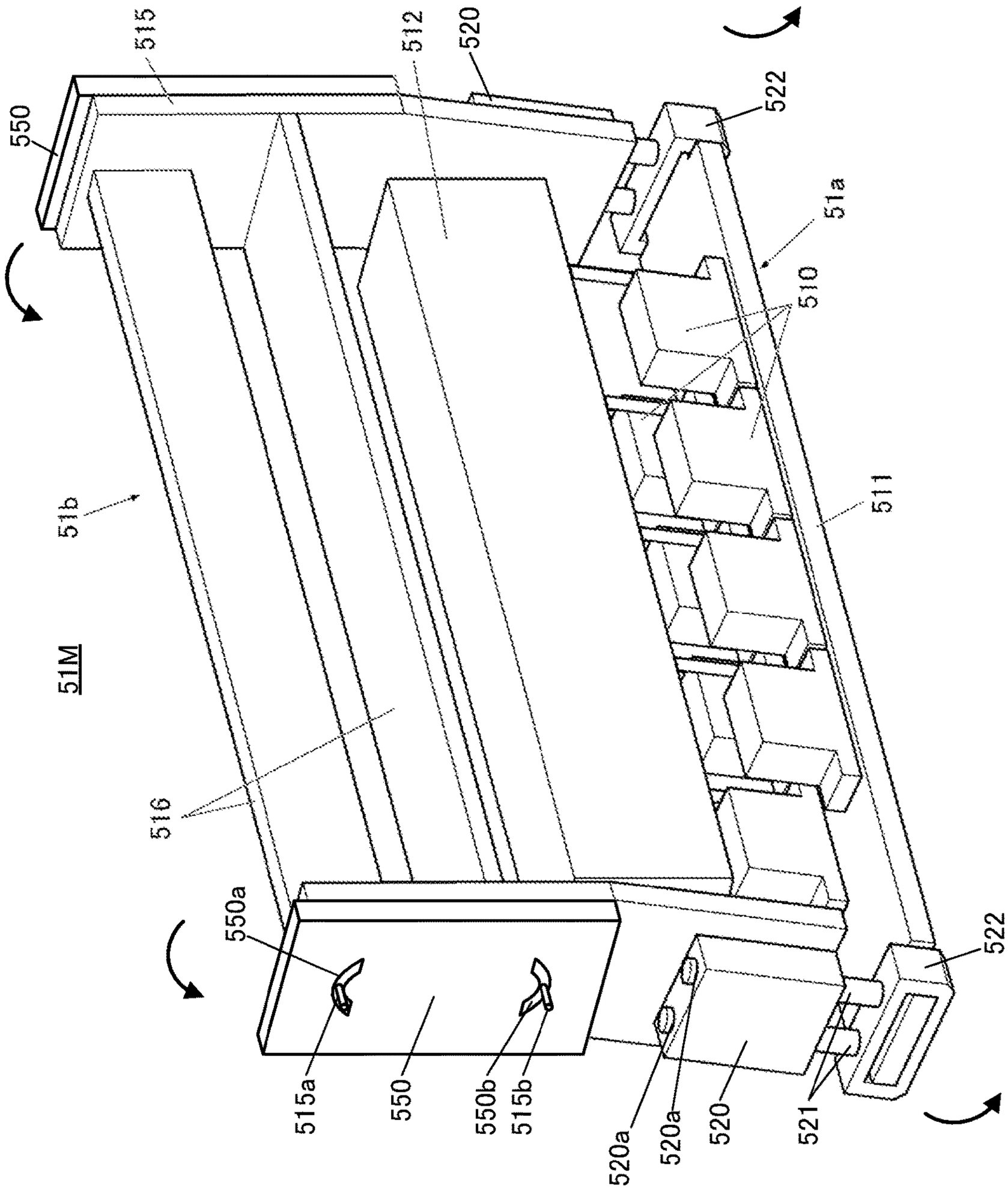
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FIG. 11

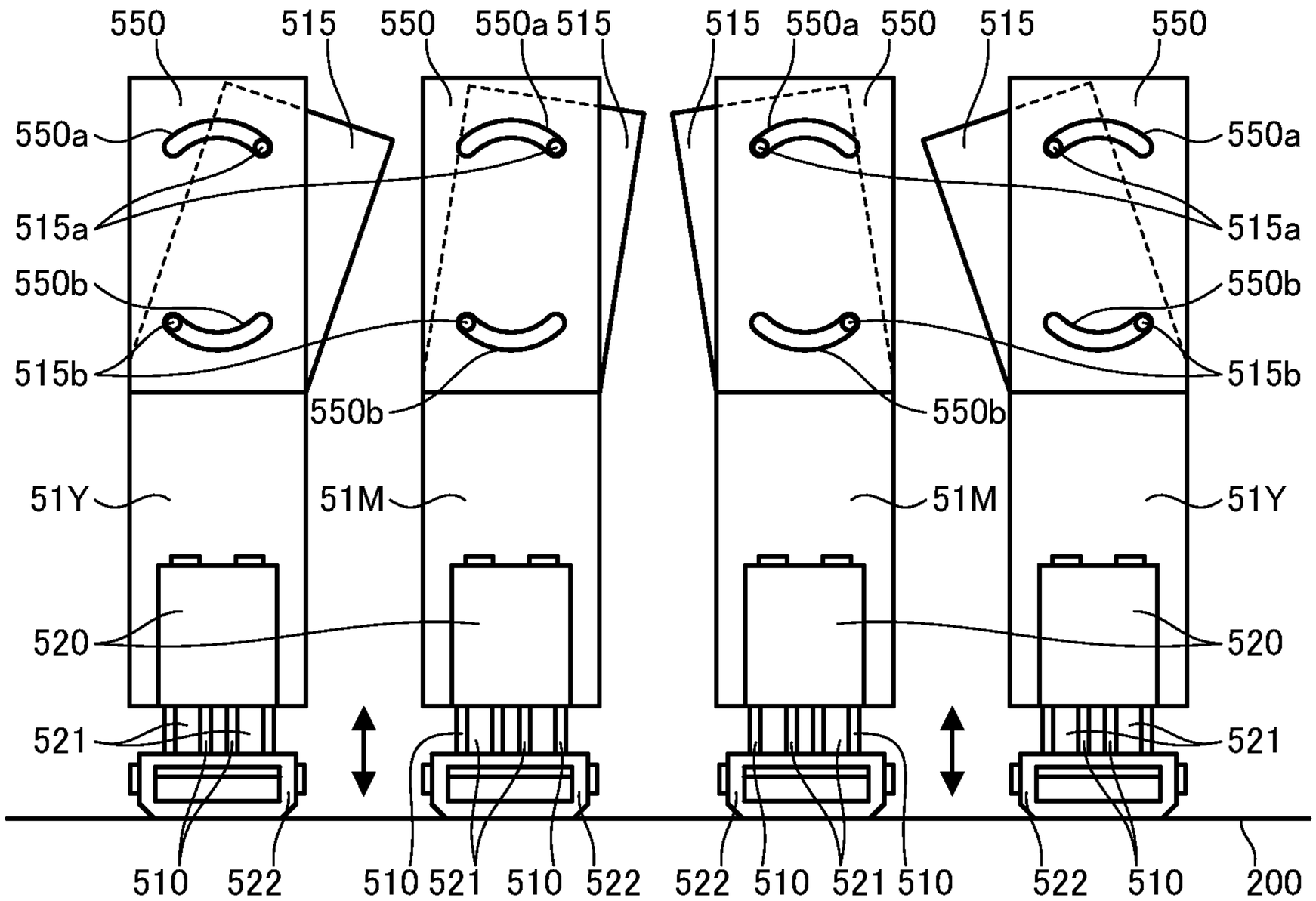
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FIG. 12

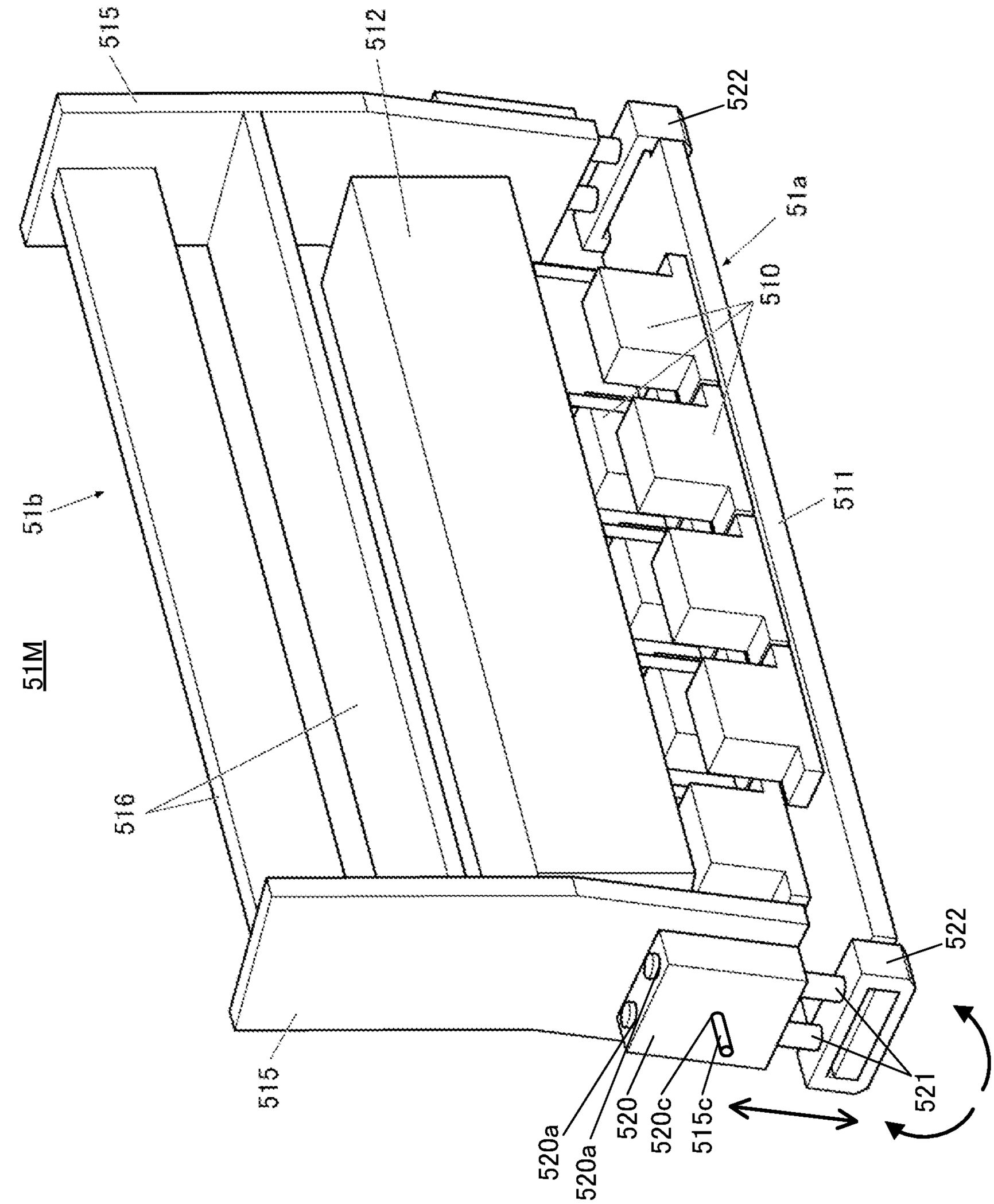
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FIG. 13

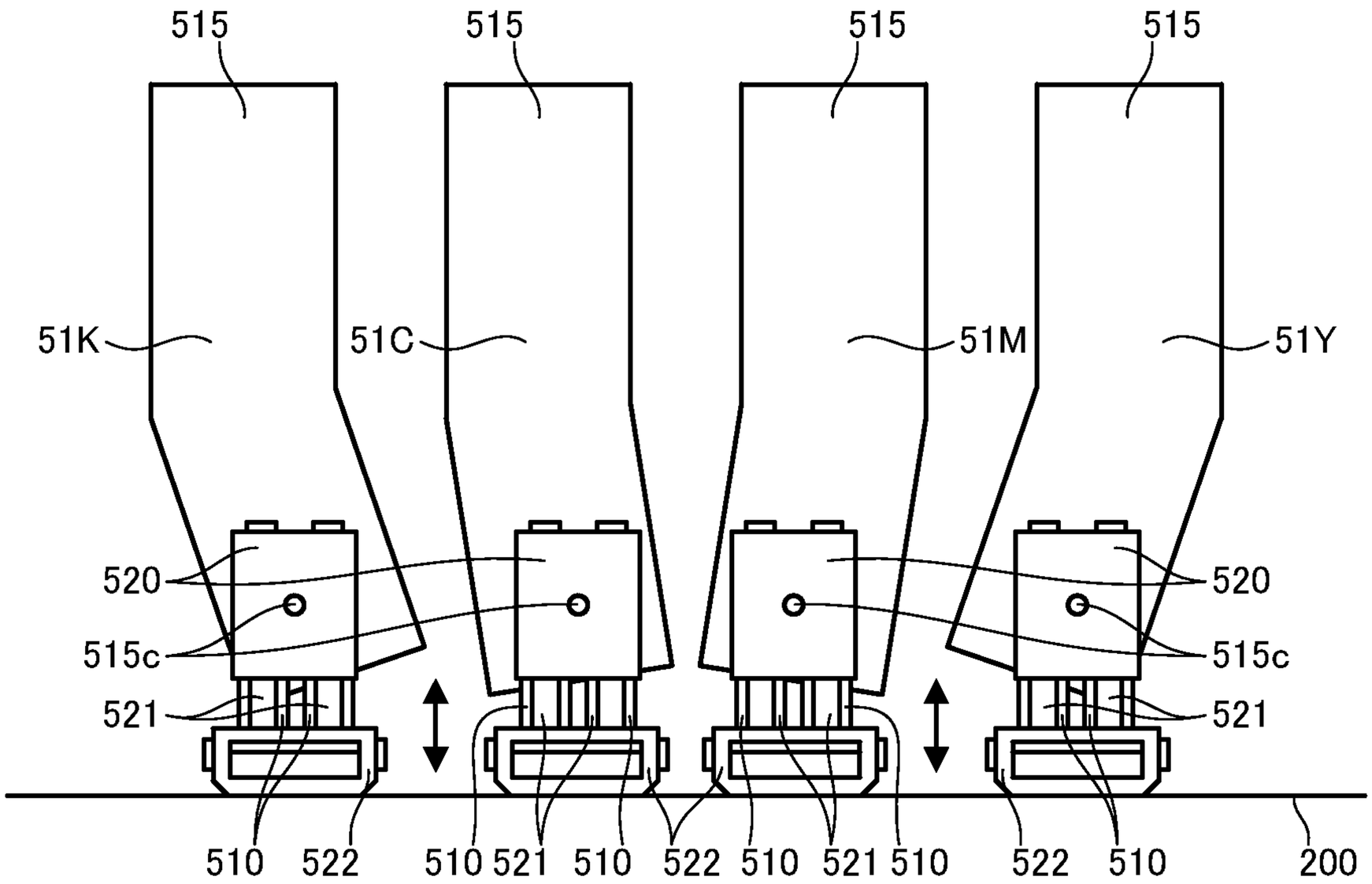
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FIG. 14

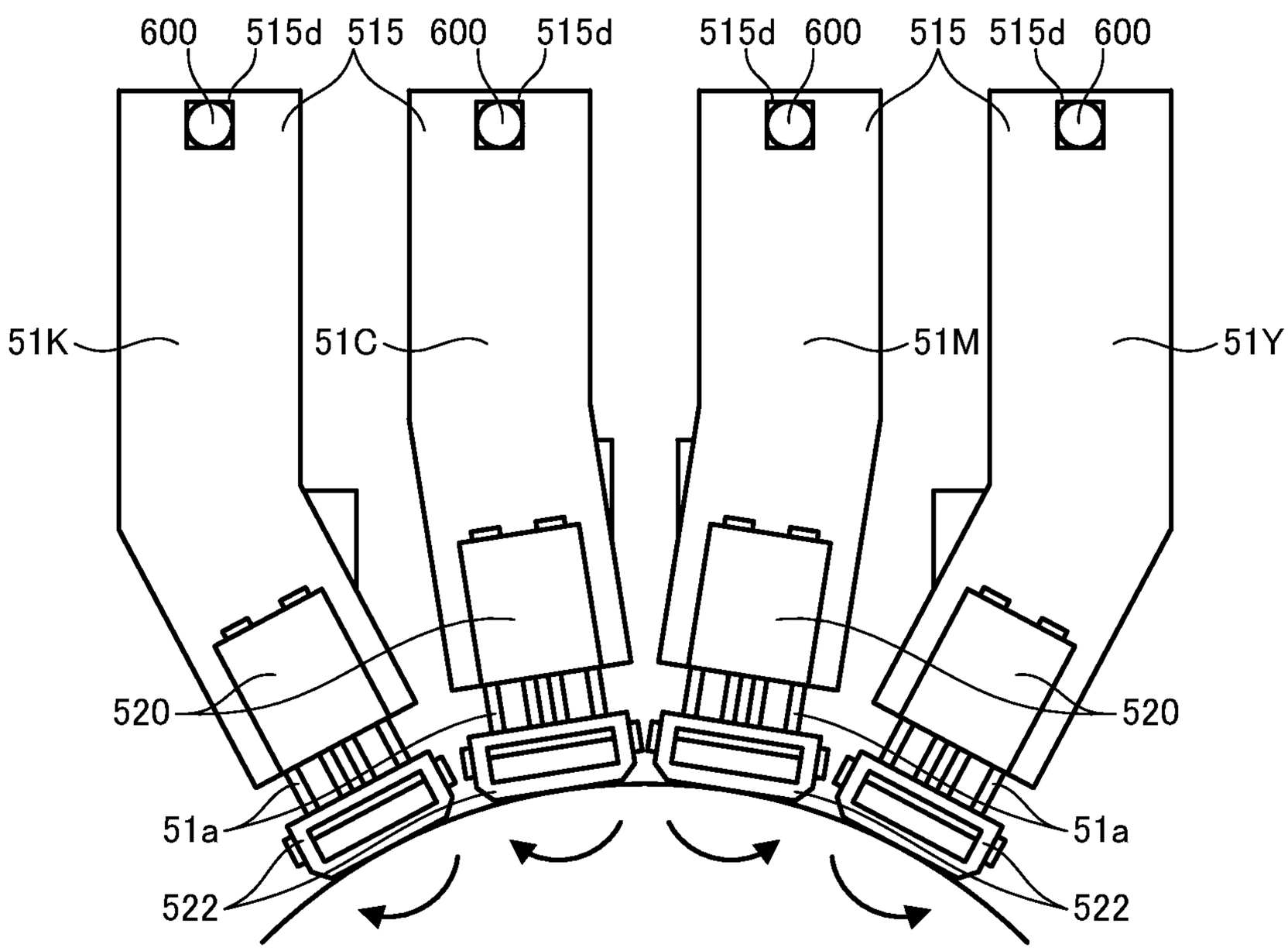
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FIG. 15

POSTURE ADJUSTING APPARATUS AND INKJET IMAGE FORMING APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

The entire disclosure of Japanese Patent Application No. 2018-207249 filed on Nov. 2, 2018 is incorporated herein by reference in its entirety.

BACKGROUND

Technological Field

The present invention relates to a posture adjusting apparatus and an inkjet image forming apparatus.

Description of Related Art

In recent years, an image forming apparatus using an inkjet printing (hereinafter referred to as an inkjet image forming apparatus) has been widely used as an apparatus for recording high-definition images in various recording media such as paper and fabric. Known inkjet image forming apparatuses include, for example, one that is described in Japanese Patent Application Laid-Open No. 2013-230643 (hereinafter referred to as "PTL 1"), which includes an image forming drum that holds a recording medium on the outer peripheral surface and conveys it, and is provided with a plurality of detachable inkjet heads for forming images by ejecting ink onto a recording medium conveyed by image forming drum.

In the technique described in PTL 1, a carriage for driving the heads can be moved to a maintenance position, and two work doors are provided in positions across the heads moved to the maintenance position, so that the heads can be accessed by the operator from both sides.

On the other hand, the configuration described in PTL 1 has a problem in that the heads are not easily attached and detached for head exchange because the posture of the heads moved to the maintenance position is inclined.

SUMMARY

An object of the present invention is to provide a posture adjusting apparatus and an inkjet image forming apparatus that can improve workability for attaching and detaching heads.

To achieve at least one of the abovementioned objects, according to an aspect of the present invention, a posture adjusting apparatus reflecting one aspect of the present invention comprises:

an ink ejector that has a detachable inkjet head that ejects ink; and

a posture adjuster for adjusting a posture of the ink ejector.

To achieve at least one of the abovementioned objects, according to an aspect of the present invention, an inkjet image forming reflecting one aspect of the present invention comprises:

the posture adjusting apparatus described above; and

a conveyor disposed in a first position where an image is formed by the inkjet head, the conveyor conveying a recording medium.

BRIEF DESCRIPTION OF DRAWINGS

The advantages and features provided by one or more embodiments of the invention will become more fully understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention:

FIG. **1** is a schematic configuration diagram of an inkjet image forming apparatus according to this embodiment;

FIG. **2** is a diagram showing the internal configuration of an image forming section;

FIG. **3** is a perspective view showing a schematic configuration of an ink ejection section;

FIG. **4** is a front view showing a schematic configuration of the ink ejection section;

FIG. **5** is a bottom view showing a schematic configuration of the ink ejection section;

FIG. **6** is a perspective view showing a schematic configuration of an enclosure;

FIG. **7** is a diagram for explaining the positioning of an image forming drum and the ink ejection section inside the enclosure;

FIG. **8** is a diagram showing the print position and maintenance position inside the enclosure;

FIG. **9** is an explanatory diagram related to the standing position of an operator who performs maintenance work inside the enclosure;

FIG. **10** is a diagram for explaining problems in performing maintenance work inside the enclosure;

FIG. **11** is a diagram showing a first configuration example of a head angle adjusting mechanism (posture adjuster section) in this embodiment;

FIG. **12** is a side view showing a state after angle adjustment in the first configuration example;

FIG. **13** is a diagram showing a second configuration example of the head angle adjusting mechanism (posture adjuster section) in this embodiment;

FIG. **14** is a side view showing a state after angle adjustment in the second configuration example; and

FIG. **15** is a diagram showing a third configuration example of the head angle adjusting mechanism (posture adjuster section) in this embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

Hereinafter, one or more embodiments of the present invention will be described with reference to the drawings. However, the scope of the invention is not limited to the disclosed embodiments.

FIG. **1** is a schematic view showing the internal configuration of inkjet recording apparatus **1** serving as an inkjet image forming apparatus according to this embodiment. As shown in FIG. **1**, inkjet recording apparatus **1** of this embodiment includes image forming section **2**, sheet feed section **3** that feeds paper to image forming section **2**, and collection section **4** that collects recording medium P on which an image is formed by image forming section **2**.

Sheet feed section **3** includes sheet feed tray **31** that contains recording medium P, a sheet feed conveyor section **32** that conveys recording medium P from sheet feed tray **31** to image forming section **2**, and supply section **33** that supplies recording medium P in sheet feed tray **31** to sheet feed conveyor section **32**. Sheet feed conveyor section **32** includes a pair of sheet feed conveyance rollers **321** and **322**, and sheet feed conveyance belt **323** is hung around the sheet feed conveyance rollers **321** and **322**. Sheet feed conveyance belt **323** takes this recording medium P supplied from sheet feed tray **31** by supply section **33**, and conveys this recording medium P to image forming section **2**.

Collection section **4** includes container tray **41** that contains recording medium P on which an image is formed, and collection conveyor section **42** that conveys recording medium P from image forming section **2** to container tray **41**. Collection conveyor section **42** is provided with a plurality of collection conveyance chain sprockets **421**, **422**, and **423**. Of the plurality of collection conveyance chain sprockets **421** to **423**, one collection conveyance chain sprocket **421** is disposed in image forming section **2**, and the other collection conveyance chain sprockets **422** and **423** are disposed in collection section **4**. Recording medium P on which an image has been formed by image forming section **2** is conveyed while being held on collection conveyance belt **424** through collection claw section **425**. When it comes above container tray **41**, it is released from collection claw section **425** and contained in container tray **41**.

Next, the configuration of image forming section **2** will be described mainly with reference to FIG. **2**. As shown in FIGS. **1** and **2**, to form an image on recording medium P, image forming section **2** includes image forming drum **21** that holds this recording medium P on the surface and delivery drum **22** that delivers recording medium P conveyed from sheet feed section **3**, to image forming drum **21**.

Delivery drum **22**, which holds recording medium P on its outer peripheral surface, includes a plurality of claws that clamps one end of recording medium P, and attracting sections (not shown) for attracting recording medium P onto the outer peripheral surface. The attracting section attracts recording medium P to the outer peripheral surface of delivery drum **22** by electrostatic attraction or suction. Delivery drum **22** has a part of the outer periphery close to image forming drum **21** so that recording medium P is delivered to image forming drum **21** at this close portion.

In one specific example, image forming section **2** uses ink that changes in phase from gel to liquid according to temperature, and the temperature of the ink is adjusted by heating recording medium P to control the smoothness and gloss of ink dots during formation of images. Accordingly, image forming drum **21** is assumed to be heated, and the outer peripheral surface of this image forming drum **21** has a multilayer structure in which a heat storage layer is formed on a heat insulating layer.

As shown in FIG. **2**, a plurality of ink ejection sections **51**, UV lamp **52**, drum temperature sensor **91**, heating rollers **71** and **72**, and cooling fan **53** are disposed around image forming drum **21** in image forming section **2**. Image forming drum **21**, ink ejection section **51**, and the like are accommodated in enclosure **20** (see FIG. **1**) of image forming section **2**.

In this embodiment, among sheet feed conveyor section **32** that conveys recording medium P, delivery drum **22**, image forming drum **21**, and collection conveyor section **42**, delivery drum **22**, image forming drum **21**, and a part of collection conveyor section **42** accommodated in enclosure **20** correspond to a conveyor section that conveys recording medium P. The detailed configuration of enclosure **20** will be described later.

Ink ejection section **51** is configured so that inkjet heads (recording heads **510** which will be described later) that eject ink can be attached and detached to/from it, and includes head section **51***a* that ejects ink and carriage **51***b* that holds head section **51***a*.

In this example, a total of four ink ejection sections **51** (**51**K, **51**C, **51**M, and **51**Y) are provided so that four colors of ink of black (K), yellow (Y), magenta (M), and cyan (C) can be ejected. In inkjet recording apparatus **1**, the number of ink ejection sections **51** can be increased or decreased in accordance with the number of necessary colors (see FIG. **10** in which white (W) is added).

Head sections **51***a* in these ink ejection sections **51**K, **51**C, **51**M, and **51**Y are arranged along the circumferential direction of image forming drum **21** and along the conveyance direction of recording medium P as shown in FIG. **2**. In this example, head sections **51***a* are line-type recording head sections that extend over the entire length of image forming drum **21** (the axial length of the drum (the same applies hereinafter)).

As shown in FIG. **2**, for example, ultraviolet (UV) lamp **52** for radiating energy rays such as ultraviolet rays is disposed immediately downstream in the conveyance direction from recording medium P in the plurality of ink ejection sections **51**. UV lamp **52** extends over the entire length of image forming drum **21** and irradiates recording medium P lying on image forming drum **21** with energy rays.

Collection conveyance chain sprocket **421** of the aforementioned collection conveyor section **42** is disposed immediately downstream in conveyance direction Y from UV lamp **52**. A part of the outer periphery of collection conveyance chain sprocket **421** approaches image forming drum **21** via collection conveyance belt **424**, and recording medium P is delivered from image forming drum **21** to collection conveyance belt **424** through this approaching part. Further, a cooling fan **53** that cools the outer peripheral surface of image forming drum **21** by blowing air is provided immediately downstream from collection conveyance chain sprocket **421**. Heating roller **72** of the second heating section is provided immediately downstream from cooling fan **53**, and drum temperature sensor **91** that measures the surface temperature of image forming drum **21** is also disposed immediately downstream therefrom.

Heating roller **71** as a heating body heats recording medium P that is held on image forming drum **21** and has yet to be subject to recording through ink ejection section **51**, and is disposed immediately downstream in conveyance direction Y from delivery drum **22**, that is, between delivery drum **22** and ink ejection section **51**. Although not shown, heating roller **71** includes a hollow pipe made of a metal, such as aluminum, an elastic layer, such as silicon rubber, covering the entire circumference of the hollow pipe, and a heating source, such as a halogen heater, built in the hollow pipe for heating entire heating roller **71**. The roller surface of heating roller **71** is in contact with the outer peripheral surface of image forming drum **21**, and recording medium P is interposed between heating roller **71** and image forming drum **21** during formation of an image. At this time, heating roller **71** presses recording medium P against the outer peripheral surface of image forming drum **21** to bring it into close contact therewith.

In inkjet recording apparatus **1**, heating section temperature sensor **92** that detects the temperature of heating roller **71** of the first heating section is also provided to heating roller **71**. Further, around image forming drum **21**, heating roller **72** having the same structure as above-described heating roller **71** is provided downstream from collection conveyance chain sprocket **421** and upstream from delivery drum **22** (specifically, between cooling fan **53** and drum temperature sensor **91**).

Next, the more specific configuration of ink ejection section **51** will be described with reference to FIGS. **3** to **5**. The four ink ejection sections **51** (**51**K, **51**C, **51**M, and **51**Y) described above have the same configuration except for the ink used and the parts specifically described. Therefore, the following describes ink ejection section **51**M as a representative. FIG. **3** is a perspective view showing the configura-

tion of ink ejection section **51**M. FIG. **4** is a front view of ink ejection section **51**M, and FIG. **5** is a bottom view of ink ejection section **51**M. As shown in FIGS. **3** to **5**, ink ejection section **51** (**51**M) includes head section **51***a* and carriage **51***b* that holds head section **51***a*.

Head section **51***a* includes a plurality of recording heads **510** that eject ink (corresponding to the "inkjet head" of the present invention), head fixing plate **511** on which the plurality of recording heads **510** are detachably disposed, and ink tank **512** that stores ink to be supplied to each recording head **510**. FIG. **3** and other drawings show an exterior case (**512**) of the ink tank (container), and the exterior case is fixed to side plates **515**. In addition, an electronic circuit (electric component) for supplying drive current to each recording head **510** is also provided in the exterior case of the ink tank. Head section **51***a* includes ink tube **513** that constitutes a flow path for supplying ink from ink tank **512** to each recording head **510**. Of these, head fixing plate **511** of head section **51***a* corresponds to a "head fixing member" to which a plurality of (eight in this example) recording heads **510** are fixed and to/from which these recording heads **510** are attached and detached.

In this embodiment, a plurality of recording heads **510** are attached to head fixing plate **511** along the direction of the rotational axis of image forming drum **21** (see FIGS. **2** and **3**). Further, in this embodiment, the plurality of recording heads **510** are arranged on head fixing plate **511** so as to form a plurality of rows along a direction that intersects the direction of conveyance of recording medium P by image forming drum **21** (in the illustrated example, a direction orthogonal to the conveyance direction). In this embodiment, as shown in FIGS. **3** and **4**, recording heads **510** are fixed to head fixing plate **511** so that they are arranged in two rows each including four recording heads **510** and eight recording heads **510** are arranged in a staggered manner.

In this embodiment, head fixing plate **511** has a length equal to the entire length of image forming drum **21** described above. Planar rectangular eight opening sections (see FIG. **5**) are formed in a zigzag pattern so that recording heads **510** are detachably fixed to head fixing plate **511**, and the ink ejected from recording heads **510** can be ejected toward the outer peripheral surface of image forming drum **21**. The recording heads **510** are attached to the opening sections in head fixing plate **511** so that its ink ejection surface is exposed on the lower surface of head fixing plate **511**, and eject ink from the lower surface side of head fixing plate **511**.

As shown in FIGS. **3** and **4**, carriage **51***b* includes a pair of arm-like side plates **515** that hold head fixing plate **511** so as to clamp opposite ends of head fixing plate **511**, and two coupling plates **516** that couple the pair of side plates **515**.

Although not shown, the upper portion of the side plates **515** in carriage **51***b* is connected to a rail that extends in a direction intersecting with (in this example, a direction orthogonal to) the direction of the conveyance of recording medium P (see FIG. **15** as appropriate). Carriages **51***b* of each of the four ink ejection sections **51**K, **51**C, **51**M, and **51**Y is configured to be individually movable along the corresponding rail in a direction intersecting with the direction of the conveyance of recording medium P. With this configuration, head section **51***a* mounted on each carriage **51***b* is individually movable. To be specific, ink ejection sections **51**K, **51**C, **51**M, and **51**Y can be moved to a print position (first position) where they face image forming drum **21** to form an image and to a maintenance position (second position) where they get away from image forming drum **21** toward a direction intersecting with the direction of the conveyance of recording medium P. This will be described later.

Moreover, carriage **51***b* is mainly provided with a height adjusting section for adjusting the distance or height of head fixing plate **511** with respect to image forming drum **21**. The height adjusting section includes a pair of holder sections **520** fixed to the lower portion outside each side plate **515**, a pair of bases **522** fixed to opposite ends in the length direction of head fixing plate **511**, and a plurality of (two in this example) columnar base shafts **521** that extend upward and are provided on the base **522** (see FIG. **3**).

Here, holder section **520** includes two holes **520***a* passing in the up-and-down direction and extending by a diameter corresponding to the diameter of base shaft **521**, and base shaft **521** inserted into each hole **520***a* is fixed (held) by, for example, fastening such as screwing. With this configuration, as indicated by the double-headed arrows in FIG. **3**, the distances between the two holder sections **520** and the side plates **515** and the corresponding bases **522** and head fixing plate **511** are adjusted so that the distance or height of head fixing plate **511** with respect to image forming drum **21** can be individually adjusted on the back side and the near side of the apparatus.

FIG. **6** is a perspective view showing a schematic configuration of enclosure **20** in image forming section **2**. FIG. **7** is an explanatory diagram showing the positioning of image forming drum **21** and ink ejection section **51** inside enclosure **20**. FIG. **8** is an explanatory diagram showing print position R**1** and maintenance position R**2** inside enclosure **20**.

As shown in FIGS. **1** and **6**, image forming section **2** includes enclosure **20** that accommodates the above-described image forming drum **21**, the plurality of ink ejection sections **51** (head sections **51***a* and carriages **51***b*), and the like. Enclosure **20** covers the periphery of ink ejection section **51** in order to prevent the UV curable ink from being exposed to natural light until the UV curable ink is cured by UV lamp **52**, particularly to accommodate head section **51***a* of ink ejection section **51** in the light shielding space.

Enclosure **20** has openable and closable doors **20***a* and **20***b* attached to the working openings (opening sections) in two wall surfaces extending in a direction substantially parallel to the rotation axis of image forming drum **21** so that an operator can enter and exit for the maintenance of, for example, a plurality of ink ejection sections **51** (head sections **51***a* and carriages **51***b*) in image forming section **2**. Window section **20***c* is provided to a wall surface of enclosure **20** that extends in a direction orthogonal to the rotation axis of image forming drum **21**.

An opening section **20***d* into which one end of the above-described sheet feed conveyance belt **323** (see FIG. **1**) is inserted is formed in the wall surface provided with door **20***a*. An opening section **20***e* into which one end of the above-described collection conveyance belt **424** is inserted is formed in the wall surface provided with door **20***b*.

In enclosure **20**, doors **20***a* and **20***b* are doors that are opened and closed when an operator enters and leaves enclosure **20** for maintenance. Window section **20***c* is a door that can be opened for checking the state of the inside of enclosure **20**.

In enclosure **20**, one door **20***a* is provided on the wall surface located upstream in the direction of the conveyance of recording medium P from the rotation axis of image forming drum **21**. The other door **20***b* is provided on the wall surface located downstream in the direction of the conveyance of recording medium P from the rotation axis of image

forming drum **21**. Window section **20***c* is provided on the wall surface close to a side of image forming drum **21**.

Enclosure **20** as a whole including doors **20***a* and **20***b* and window section **20***c* is preferably composed mainly of a metal material that does not transmit natural light. However, for window section **20***c*, an acrylic plate that has been subjected to UV cut processing may be used so that the state of the inside can be checked without opening window section **20***c*.

In this enclosure **20**, image forming drum **21** is between a pair of highly rigid side plates **210** and is rotatably supported (see FIG. **7**). In addition, maintenance tank **200** is provided on a side of image forming drum **21** and in a position out of the path of the conveyance of recording medium P, in enclosure **20**. This maintenance tank **200** has a function of preventing the replacement parts from dropping during maintenance of ink ejection section **51**, and functions as a tray (receiving section) for receiving ink dropped by pressure discharge for removing foreign matters and bubbles from recording head **510**.

In this embodiment, a carriage moving section is provided for changing the position of each of the plurality of ink ejection sections **51** (**51**K, **51**C, **51**M, and **51**Y) to print position R**1** or maintenance position R**2**. The carriage moving section includes a drive source, such as a motor or a solenoid (not shown), for each of the ink ejection sections **51**K, **51**C, **51**M, and **51**Y. The drive force of the drive source is transmitted to carriage **51***b* (for example, side plate **515**) of the corresponding ink ejection section **51**K, **51**C, **51**M, or **51**Y, so that this carriage **51***b* is moved along the rail described above (see the double-headed arrow in FIG. **8**) to print position R**1** or maintenance position R**2**.

In this embodiment, as shown in FIG. **7**, the aforementioned operation of the carriage moving section locates all the ink ejection sections **51** (**51**K, **51**C, **51**M, and **51**Y) to print position R**1** (first position) facing image forming drum **21**, during formation of an image. In contrast, during maintenance, the plurality of ink ejection sections **51** are individually moved to maintenance position R**2** (second position) located in the direction away from image forming drum **21** and above maintenance tank **200** (see FIG. **8**).

During this maintenance, operators enter enclosure **20** from door **20***a* and door **20***b*, respectively, so that as shown in FIG. **9**, the operators can enter two positions across ink ejection section **51** that has been moved to maintenance position R**2** and perform maintenance work from both sides of ink ejection section **51**.

As described above, in inkjet recording apparatus **1**, arbitrary ink ejection sections **51** (that is, head section **51***a* and carriage **51***b*) of the plurality of ink ejection sections **51** can individually be moved to maintenance position R**2** in a direction away from image forming drum **21**. In inkjet recording apparatus **1**, the operators enter enclosure **20** from doors **20***a* and **20***b*, respectively, and can therefore approach from both sides of carriage **51***b* that has been moved to maintenance position R**2**. Further, in inkjet recording apparatus **1**, one carriage **51***b* that has been moved to maintenance position R**2** is faced by two operators from both sides so that various types of maintenance work can be performed.

However, with the above-described configuration, the problem arises that workability for attaching and detaching recording head **510** to/from head fixing plate **511** for changing recording head **510** by moving ink ejection section **51** (carriage **51***b* and the like) to maintenance position R**2** is poor.

To be specific, as described above, carriage **51***b* moves to maintenance position R**2** along each connected rail. Here, with the conventional configuration, the postures of carriage **51***b* and head section **51***a* that have been moved to maintenance position R**2** (the angles to image forming drum **21**) are the same as before the movement.

More specifically, as schematically shown in FIG. **10**, the basic posture of ink ejection section **51** in image forming position R**1** is such a posture that the ink ejected from recording head **510** is oriented at an angle toward the rotation axis (rotation center) of image forming drum **21**. For this reason, side plates **515** of carriage **51***b* are bent so that the bottom surface of head fixing plate **511** in the corresponding head section **51***a* is parallel to the circumscribing line of the peripheral surface of image forming drum **21** (see FIG. **2**, for example). Even when carriage **51***b* moves along the rail from image forming position R**1** to maintenance position R**2**, the aforementioned basic posture is maintained because aforementioned side plates **515** are connected to the rail.

For this reason, with the conventional configuration, maintenance work should be performed in a state where head fixing plate **511** and recording head **510** are slightly inclined with respect to the floor surface of enclosure **20** and maintenance tank **200**, and how they are inclined or their inclination angles differ between ink ejection sections **51**. When the operator attaches and detaches recording head **510** with such inclination, depending on the location of recording head **510** on head fixing plate **511**, ink tank **512** and coupling plate **516** above recording head **510** may become an obstacle, which makes it difficult for the operator's hand to reach that recording head **510** (see FIG. **10** and other drawings as appropriate) and deteriorates the attachment/detachment workability.

Accordingly, in this embodiment, a posture adjusting section is provided for adjusting the posture of ink ejection section **51** and thus head fixing plate **511** moved to maintenance position R**2**. In this embodiment, the posture adjusting section changes the angle of the entire ink ejection section **51** or changes the angle of head fixing plate **511**, thereby changing the angle of each recording head **510** mounted on head fixing plate **511** with respect to image forming drum **21** from the basic posture described above. This posture adjusting section will hereinafter be referred to as a "head angle adjusting section".

In this embodiment, the head angle adjusting section allows adjustment of the angle (orientation) of at least head fixing plate **511** to which recording head **510** is attached in carriage **51***b*, thereby changing the angle of a plurality (eight in this example) of recording heads **510** at once. More specifically, the head angle adjusting section has a mechanism for changing the angle (orientation) of the bottom surface of head fixing plate **511** to the horizontal direction, thereby changing the attaching/detaching orientations of eight recording heads **510** with respect to head fixing plate **511** to the vertical direction.

A specific configuration example of the head angle adjusting section will be described below mainly using ink ejection section **51**M as a representative.

First Configuration Example

FIG. **11** shows a first configuration example of the head angle adjusting section. The head angle adjusting section of the first configuration example has a mechanism for changing the angle of carriage **51***b* and thus the entire ink ejection section **51** in the state where carriage **51***b* has been moved to maintenance position R**2**.

More specifically, the head angle adjusting section of the first configuration example includes a pair of guide plates **550** that are assembled so as to be movable (in this example, rotatable) relatively to the side surfaces of a pair of side plates **515** of carriage **51***b*. In this example, upper parts of guide plates **550** are connected to the aforementioned rail, and reciprocate between print position R**1** and maintenance position R**2** along the rail. For this reason, the posture of guide plates **550** (the angle to image forming drum **21**) is the same before and after the movement, that is, in print position R**1** and maintenance position R**2**.

In the first configuration example, side plates **515** (side plates) of carriage **51***b* are not connected to the rail. In the head angle adjusting section of the first configuration example, in order to adjust the posture (angle) of side plate **515** with respect to guide plate **550**, a long hole and a shaft are provided in both of these members. In the example shown in FIG. **11**, two shafts **515***a* and **515***b* are provided on side plates **515**, and long holes **550***a* and **550***b* into which the shafts **515***a* and **515***b* are inserted are formed in guide plates **550**.

In the first configuration example, the head angle adjusting section is composed of guide plates **550** having long holes **550***a* and **550***b* described above and shafts **515***a* and **515***b* provided to side plates **515**.

In one example, during maintenance work, the operator moves any one of carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y from print position R**1** to maintenance position R**2** together with guide plates **550**, while maintaining the posture shown in FIG. **11**. The operator then moves (for example, rotates) side plates **515** of carriage **51***b* so that the posture with respect to guide plates **550** having a fixed posture is changed in the state where it has been moved to maintenance position R**2**. At this time, shafts **515***a* and **515***b* of side plates **515** move while their movements are restricted by long holes **550***a* and **550***b* in guide plates **550**.

In the first configuration example, as shown in FIG. **12**, such an operation makes the angle (orientation) of the bottom surface of head fixing plate **511** horizontal, and appropriate operation of the above-described height adjustment section can bring the bottom surface of head fixing plate **511** into contact with maintenance tank **200**. Thus, with the head angle adjusting section of the first configuration example, the posture of carriage **51***b* and thus head fixing plate **511** with respect to guide plates **550** is changed so that the angle (orientation) of the bottom surface of head fixing plate **511** is horizontal; thus, the orientations of attaching/detaching eight recording heads **510** to head fixing plate **511** can be changed to the vertical direction.

As shown in FIG. **12**, in this embodiment, provided is a mechanism similar to the mechanism of the angle adjusting section described with reference to FIG. **11** for each of the carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y. Therefore, in any of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y, the attachment/detachment direction of each recording head **510** with respect to head fixing plate **511** can be changed to a fixed direction (vertical direction in this embodiment), which can improve the workability when recording head **510** is attached and detached by the operator.

In the example shown in FIGS. **11** and **12**, long holes **550***a* and **550***b* have an arc shape, and the pair of side plates **515** of carriage **51***b* rotates along the arcs of long holes **550***a* and **550***b* with respect to the pair of guide plates **550**. On the other hand, the shape of long holes **550***a* and **550***b* is not limited to this, and may be any shape that can adjust the angle (orientation) of the bottom surface of head fixing plate **511** to horizontal one.

Second Configuration Example

FIG. **13** shows a second configuration example of head angle adjusting section. The head angle adjusting section of the second configuration example has a mechanism that allows the angle of head fixing plate **511** to which eight recording heads **510** are attached to be changed with respect to other members (for example, ink tank **512**, side plate **515**, and coupling plate **516**) above, in the state where carriage **51***b* has been moved to maintenance position R**2**.

In the second configuration example, side plates **515** are connected to the aforementioned rail as in the description above, and are movable between print position R**1** and maintenance position R**2** along the rail. Further, the postures of members such as side plates **515**, coupling plates **516** fixed to side plates **515**, and ink tank **512** (angles to image forming drum **21**) are the same before and after the movement, that is, in print position R**1** and maintenance position R**2**.

On the other hand, in the second configuration example, as shown in FIG. **13**, aforementioned holder section **520**, which is a component of the height adjusting section disposed outside side plates **515**, is supported rotatably on side plates **515**. In this example, cylindrical shaft **515***c* is provided at a portion below the side surface of side plate **515** facing holder section **520**, and support hole **520***a* that rotatably supports this shaft **515***c* is formed in holder section **520**. In FIG. **13**, the same applies to the configurations of holder section **520** and side plate **515** on the right side.

In the second configuration example, the head angle adjusting section is composed of holder sections **520** provided with aforementioned support holes **520***a* and shaft **515***c* provided to side plates **515**.

In one example, during the maintenance work, the operator moves any one of carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y from print position R**1** to maintenance position R**2** while maintaining the posture shown in FIG. **13**. The operator then holds head fixing plate **511** in the state where carriage **51***b* has been moved to maintenance position R**2**, and moves (rotates) head fixing plate **511** so as to change its posture (angle) with respect to side plate **515** and the like having a fixed posture. At this time, holder section **520** rotates about shaft **515***c* on side plate **515**.

In the second configuration example, as shown in FIG. **14**, the angle (orientation) of the bottom surface of head fixing plate **511** is made horizontal by the aforementioned operation, and the bottom surface of head fixing plate **511** can be brought into contact with maintenance tank **200** by appropriately operating the aforementioned height adjusting section. Thus, with the head angle adjusting section of the second configuration example, the attachment/detachment orientations of eight recording heads **510** with respect to head fixing plate **511** can be changed to the vertical direction by changing the posture of holder section **520** relative to side plate **515** so that the angle (orientation) of the bottom surface of head fixing plate **511** is horizontal.

Further, in this embodiment, as shown in FIG. **14**, a mechanism similar to the mechanism of the head angle adjusting section described with reference to FIG. **13** is provided for each of the carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y. Therefore, in any of the plurality of ink ejection sections **51**K, **51**C, **51**M, and

51Y, the attachment/detachment direction of each recording head **510** with respect to head fixing plate **511** can be changed to a fixed direction (vertical direction in this embodiment), which can improve the workability when recording head **510** is attached and detached by the operator.

Third Configuration Example

FIG. **15** shows a third configuration example of head angle adjusting section. The head angle adjusting section of the third configuration example has a mechanism for changing the angle of carriage **51***b* and thus the entire ink ejection section **51** in the state where carriage **51***b* has been moved to maintenance position R**2**, and is the same as the first configuration example in this respect.

On the other hand, in the head angle adjusting section of the third configuration example, the aforementioned guide plates **550** are not used and the attachment angle of carriage **51***b* and thus the angle of the entire ink ejection section **51** with respect to rail **600** can be moved when side plates **515** moving along rail **600** are moved to maintenance position R**2**.

In one specific example, the cross-sectional shape of rail **600** is a rectangle in the area where carriage **51***b* is in image forming position R**1**, and a circle inscribed in the rectangle (see FIG. **15**) in the area where carriage **51***b* moves to maintenance position R**2**. Here, FIG. **15** shows a cross-sectional shape of rail **600** in an area where carriage **51***b* moves to maintenance position R**2**.

Meanwhile, rectangular hole **515***d* corresponding to the aforementioned rectangular cross-sectional shape of rail **600** is formed in an upper portion of each side plate **515**.

In the third configuration example, the head angle adjusting section is composed of aforementioned rail **600** and side plates **515** each having hole **515***d* into which rail **600** is inserted.

In the third configuration example, during the maintenance work, the operator moves any one of carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y (for example, ink ejection section **51**Y) from print position R**1** to maintenance position R**2** while maintaining the posture shown in FIG. **15**. The operator then holds head fixing plate **511**, side plates **515**, or the like in the state where carriage **51***b* has been moved to maintenance position R**2**, and moves (rotates) head fixing plate **511** so as to change its posture (angle) with respect to entire ink ejection section **51** (**51**Y). At this time, side plates **515** of carriage **51***b* rotate about rail **600** inserted therethrough (see the arrows in FIG. **15**).

In the third configuration example, as in the case of first configuration example, the angle (orientation) of the bottom surface of head fixing plate **511** is made horizontal by the aforementioned operation, and the bottom surface of head fixing plate **511** can be brought into contact with maintenance tank **200** by appropriately operating the aforementioned height adjusting section (which is omitted in the drawings). Thus, with the head angle adjusting section of the third configuration example, the attachment/detachment orientations of eight recording heads **510** with respect to head fixing plate **511** can be changed to the vertical direction by changing the posture (rotational position) of side plates **515** with respect to rail **600** so that the angle (orientation) of the bottom surface of head fixing plate **511** is horizontal.

Further, in the third configuration example, as shown in FIG. **15**, the head angle adjusting section having the same mechanism is provided for each of the carriages **51***b* of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y. Therefore, in any of the plurality of ink ejection sections **51**K, **51**C, **51**M, and **51**Y, the attachment/detachment direction of each recording head **510** with respect to head fixing plate **511** can be changed to a fixed direction (vertical direction in this embodiment), which can improve the workability when recording head **510** is attached and detached by the operator.

As described above, inkjet recording apparatus **1** of this embodiment includes a head angle adjusting section (posture adjusting section) having a mechanism for changing the angle (orientation) of head fixing plate **511** from a direction toward the axis (rotation center) of image forming drum **21** in the state where ink ejection section **51** has been moved to maintenance position R**2**; therefore, the workability can be improved when recording head **510** is attached and detached to/from head fixing plate **511**.

Depending on the configuration of the head angle adjusting section, for example, when the head angle adjusting section of the second configuration example described with reference to FIG. **13** and other drawings is employed, head fixing plate **511** may move (rotate) relatively to ink tank **512** fixed to side plates **515**. In this case, a load may be applied to ink tube **513** (see FIG. **4**) that supplies ink from ink tank **512** to each recording head **510**.

Here, ink tube **513**, which is generally composed of a flexible member, may absorb a slight load. However, when the load is absorbed by ink tube **513**, the ink flow path length from ink tank **512** to recording head **510** may change (become longer). In this case, the print quality may degrade.

Accordingly, when a load may be generated on ink tube **513** due to a change in the posture of head fixing plate **511** or the like, if ink ejection section **51** is in image forming position R**1** (first position), it is preferable to set the length of ink tube **513** so as to provide a droop, that is, give a margin to the length of the ink tube in advance. With this configuration, when ink ejection section **51** is moved to maintenance position R**2** (second position) and the head angle adjusting section is operated, a load on the ink tube is avoided and the flow path length can be maintained Thus, the print quality can be maintained.

Further, in the first configuration example and the second configuration example, in order to prevent the posture of head fixing plate **511** and the like from changing during formation of an image, it is preferable that the head angle adjusting section (posture adjusting section) is operated after each of ink ejection sections **51** is moved to maintenance position R**2**(second position). In other words, it is desirable that the head angle adjusting section cannot not be operated while each of the ink ejection sections **51** is in image forming position R**1** (first position).

In a specific example of such a configuration, a known lock mechanism (not shown) is provided to the shaft (the aforementioned shafts **515***a*, **515***b*, and **515***c*) in the head angle adjusting section, and upon movement to the second position, the lock on the shaft may be released.

Although embodiments of the present invention have been described and illustrated in detail, the disclosed embodiments are made for purpose of illustration and example only and not limitation. The scope of the present invention should be interpreted by terms of the appended claims.

What is claimed is:

1. A posture adjusting apparatus, comprising:

an ink ejector that has a detachable inkjet head that ejects ink; and

a posture adjuster for adjusting a posture of the ink ejector,

wherein the ink ejector includes a head fixing member to/from which the inkjet head is attached and detached, the ink ejector being movable between a first position where an image is formed on a recording medium by the inkjet head and a second position where the inkjet head is attached and detached, and

the posture adjuster allows adjustment of an angle of the head fixing member with respect to a rail that extends in a direction intersecting a direction of conveyance of the recording medium, when the ink ejector is in the second position and the angle of the head fixing member with respect to the rail in the second position is different from the angle when the ink ejector is in the first position.

2. The posture adjusting apparatus according to claim **1**, wherein

the ink ejector includes a carriage that is coupled to the head fixing member and moves between the first position and the second position along the rail, and

the posture adjuster adjusts the angle of the head fixing member by changing a posture of the carriage relative to the rail.

3. The posture adjusting apparatus according to claim **2**, wherein

the posture adjuster includes a guide plate attached to the rail and assembled so as to be movable relatively to the carriage, and

the angle of the head fixing member is adjusted by changing the posture of the carriage relative to the guide plate.

4. The posture adjusting apparatus according to claim **2**, wherein

in the posture adjuster, a height adjuster that adjusts a height of the carriage with respect to the head fixing member is rotatable with respect to the carriage so that the angle of the head fixing member is adjusted.

5. The posture adjusting apparatus according to claim **2**, wherein

a hole to which the rail is inserted is formed at an upper portion of the carriage, and

the posture adjuster allows an attachment angle of the carriage to be changed with respect to the rail once the carriage comes to the second position.

6. The posture adjusting apparatus according to claim **1**, wherein the posture adjuster is operated after the ink ejector is moved to the second position.

7. An inkjet image forming apparatus, comprising:

the posture adjusting apparatus according to claim **1**; and

a conveyor disposed in a first position where an image is formed by the inkjet head, the conveyor conveying a recording medium.

8. The inkjet image forming apparatus according to claim **7**, wherein

a plurality of the ink ejectors are provided; and

the posture adjusting apparatus is provided in each of the plurality of the ink ejectors.

9. The inkjet image forming apparatus according to claim **8**, wherein

each of the plurality of the ink ejectors is movable between the first position and a second position where the inkjet head is attached and detached.

10. The inkjet image forming apparatus according to claim **7**, further comprising:

an enclosure that accommodates the conveyor and the ink ejector, wherein

openings for operation are provided in walls of the enclosure located upstream and downstream in a direction of conveyance of the recording medium.

11. The inkjet image forming apparatus according to claim **9**, wherein a receiver

that receives ink dropping from the ink ejector is provided in the second position.

12. The inkjet image forming apparatus according to claim **10**, wherein the openings are provided with a door for an operator to enter and exit.

13. The inkjet image forming apparatus according to claim **7**, wherein the conveyor includes an image forming drum that conveys the recording medium while holding the recording medium on an outer peripheral surface.

14. The inkjet image forming apparatus according to claim **13**, wherein

the ink ejector includes a head fixing member to/from which a plurality of the inkjet heads are attached and detached, and

the plurality of the inkjet heads are arranged on the head fixing member along an axial direction of the image forming drum.

15. The inkjet image forming apparatus according to claim **14**, wherein

the plurality of the inkjet heads are attached to the head fixing member in a plurality of rows along the direction of conveyance of the recording medium, the inkjet image forming apparatus further comprising:

an ink tank that supplies ink to the inkjet head, and an electric component that supplies a drive current to the inkjet heads, both above the plurality of the inkjet heads.

16. The inkjet image forming apparatus according to claim **15**, further comprising:

an ink tube that supplies ink from the ink tank to the inkjet heads, wherein

a change in flow path length due to the ink tube is avoided even when a posture of the ink ejector is adjusted by the posture adjuster.

17. The inkjet image forming apparatus according to claim **16**, wherein a length of the ink tube is set so as to provide a droop when the ink ejector is in the first position.

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